



INNOVATION IN SUSTAINABLE CONSTRUCTION: ECO-CITIES AND SOCIAL HOUSING IN FRANCE AND DENMARK

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CONSTRUCTIONS MATTER - Managing Complexities, Decisions and Actions in the Building Process

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**INNOVATION IN SUSTAINABLE CONSTRUCTION:
ECO-CITIES AND SOCIAL HOUSING IN FRANCE AND DENMARK**

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INTRODUCTION

The construction sector is often characterized as a reactive sector, as lagging behind other sectors of the economy, notably industry, when it comes to innovation; as mechanically responding to external (client) needs and implementing innovations that originate elsewhere (Winch 1998, Harty 2008). The sector is often presented as un-dynamic and un-innovative and as precluding novel design practices and tools, an orientation that seems to flow from its rigid routines, professional boundaries, division of labor, national legislation, established performance measures, and fixed ideas about best practices. Accordingly, building projects in the construction sector tend to reflect objectives and institutionalized practices other than those related to innovation and sustainability.

Recently, however, innovations like zero-energy housing, eco-cities, and certified buildings have emerged as novel ways to lower energy consumption. Such innovations flow from new technologies and novel ways of working that occur in the gradual conceptualization of sustainable buildings. Once formalized, such new technologies and practices are known as new design templates. Despite recent attempts to develop new design templates through e.g. user involvement, 3D imaging, and lean management practices, it remains unclear how innovative design templates for sustainable construction can, and do, develop in this otherwise conservative industry. A better understanding of the conditions and processes that facilitate their emergence and spread may enable social actors to transform the construction sector into a more innovative and dynamic sphere of economic activity.

The anticipated benefit of this study for the construction sector extends beyond the construction sector. We also seek to illuminate how new design templates for sustainable construction produce value for society. By *value*, we mean more than financial gain for specific companies; we refer more generally to the economic, social and environmental value of sustainability innovations such as eco-cities and eco-housing. Such value may take the form of establishing better metrics for measuring CO₂ emissions from old and new buildings, developing new construction practices that lend themselves to lowering CO₂ emissions, and producing (inter-)national standards for sustainable construction. Value may also express itself in broader qualitative terms such as increased mobility, territorial attractiveness, quality of urban life, and enhanced social diversity. Hence, our objective extends beyond an improvement of the construction sector to a generation of value for society at large. Ultimately, we aim to identify *value-driven processes*, i.e. processes that generate higher value than what is currently available in the construction sector.

More specifically, we set out to explore the processes through which innovative design templates arise and affect institutionalized practices in the construction sector in such a way as to produce higher value for society. Institutionalized practices refer here to established ways of working, legislative frameworks that govern work practices, taken for granted ideas about best practices, and traditional standards and performance measures, elements which are often national in scope. We seek to understand how innovative design templates for sustainable construction, notably those that produce higher value for society, emerge in different countries. Along those lines, we seek to answer the following two research questions, one related to standards, the other to innovative construction practices:

- A) How do actors involved in the construction sector generate **standards** for sustainability (e.g. sustainability labels, national norms, and reference systems) that shape collective understandings of high value and facilitate the national spread of new design templates?
- B) How do construction actors engaged in the conception of new design templates for sustainable construction create an **innovative practice** (both concept and process) that has higher value than business as usual as defined by the construction actors themselves?

Our empirical study explores these processes of standardization and innovation in two European countries: Denmark and France. Eventually, we plan to include other countries as well. Within Denmark and France, we have collected data on two specific areas of activity, namely *eco-cities*, which represent a brand new phenomenon, and *sustainable social housing*, which refer to improvements made to an existing domain of construction. Through a comparison of these two areas of activity within Denmark and France, we hope to provide some preliminary answers to the above research questions. Naturally, further systematic study will be needed to substantiate the conclusion derived from this explorative study.

The paper is structured as follows. We first define sustainable construction and some key theoretical concepts upon which the empirical study rests. We then explain our methodological procedures, including data sources, data collection and data analysis. In the following section, we present our preliminary results in the form of substantiated answers to the two research questions. The paper concludes with a discussion of potential implications for practice and directions for further research.

SUSTAINABLE CONSTRUCTION

The notion of sustainable construction refers to the construction of new buildings and the renovation of existing ones in such a way as to minimize the building's negative environmental and social impact. Current efforts focus primarily on increasing the energy and resource efficiency through a careful selection of

materials, energy sources, and spatial orientation, yet increasing attention is being devoted to the social and economic dimensions of sustainability as well.

Legislation represents one way in which sustainable construction is being encouraged. In parallel to national legislation, the European Union has taken a number of initiatives such as the *Energy Performance of Buildings Directive* (European Council and Parliament, 2002). This directive stipulates rules for minimum energy performance that corresponds to the regional climate. It also encourages the construction sector to investigate the technical, environmental and economic possibilities for developing and implementing alternative energy systems. Furthermore, it suggests strategies for increasing the building's thermal performance in the summer period, notably through the development of passive cooling techniques.

The adoption of certification and reference systems for sustainable construction represents another driver for sustainable construction. One well-known reference system is the *Leadership in Energy and Environmental Design* (LEED), which is intended as way to ease the process of implementing legislation. Originating in the United States, LEED focuses on the creation of universally understood and accepted standards, tools, and performance criteria (U.S. Green Building Council, 2009). It encourages the integration of design and electricity sources, reflecting the concepts of net-zero-energy and zero-carbons-emissions, both of which seek to integrate alternative energy sources (e.g., photovoltaic technologies) with materials and architecture that lower the need for electrical light (e.g., high reflection paint) and air conditioning (e.g., slab radiant cooling) (Lewers, 2008). BREEAM, developed in United Kingdom, represents another internationally known reference system for sustainable construction. Both LEED and BREEAM can be considered to be process oriented, rather than performance oriented, reference systems. Certification is also considered to have a positive reputation effect.

A third way of encouraging sustainable construction consists in process tools, such as the North American ISO certifications. LEAN represents another such process tool that emphasizes value for the end customer, work structuring, and control of the production process (Lapinski et al, 2006; Sedam 2007). Although LEAN does not specifically address sustainability, there is nothing to preclude its applicability to sustainability.

Finally, there are economic drivers, such as the development of economic evaluation criteria that encourage private investors to recognize the economic benefits of using alternative energy sources (Eiffert, 2003), adopt sustainable design templates, and to implement environmental designs (Miller et al, 2008). Economic benefits can also be realized through increased consumer demand for sustainable buildings and government subsidies to sustainable construction. Developers are also likely to embrace LEED and other reference systems because the certification may allow them to sell the building at a greater price.

In light of the mainstreaming associated with the implementation of EU directives etc., it is likely that the move towards sustainable construction in different European countries will come to resemble each other. Yet, the same sustainable trends may take somewhat different shape depending on the country in which they are implemented, in part because EU directives encourage each country to implement EU legislation in accordance with their own priorities. There is some indication that interpretations of the same sustainability elements vary somewhat across member states (Thomsen et al, 2009) and that there is variation in the degree to which each country fulfills EU requirements. In addition, implicit institutional factors may lead to different interpretations and practices.

TRANSLATION

The institutionalist literature on translation shows that new technologies and practices take different shape depending upon the country in which they are implemented. Although a best practice may be formulated similarly across countries, it is often understood and used differently when implemented in practice. Interpretive studies show that actors who use different frames of references (e.g., national cultures) ascribe different meaning to the same phenomenon (Westenholz, 1993). The meaning ascribed to new trends in the macro-environment is thus translated into different organizational practices, forms and artifacts.

Knowledge developed by institutionalist scholars provide a useful framework for studying how institutional factors impact on innovation processes, particularly the regulatory, normative and mimetic mechanisms at play. The growing stream of translation research illuminates processes through which new practices and technologies are reinterpreted and transformed as they, after diffusing from one place to another, are implemented in new institutionalized settings. They are not simply copied but subject to intentional and unintentional change as they are communicated, enacted, and adopted in practice (Boxenbaum & Battilana 2005; Boxenbaum 2006; Czarniawska 1996; Georg & Füssel 2000; Georg 2006; Lippi 2000; Sahlin-Anderson 2001; Zilber 2006). Such translation processes apply generally to all innovations and imports, and thus, by extension, to sustainable construction. New sustainable technologies and practices are subject to local institutionalized interpretations that - once they 'freeze' - produce new design templates for sustainable construction that are country-specific.

DESIGN REGIMES

The literature on design regimes is located at the crossroad between organization theory and design theory and focuses on the design process, i.e., activities that range from concept generation, via detailed design, to

the marketing of new products and services. One prominent stream of research within this literature distinguishes between *rule-based design* and *innovative design* (Le Masson et al., 2006). Rule-based design has emerged over the last century as firms have made significant effort to rationalize their design activities in order to increase their performance. In rule-based design, coherence and organization are achieved by setting rules in four areas of the innovation process: i) designing the business model, including identification of value sources and performance targets; ii) developing templates for the division of labor and for organizational and managerial procedures; iii) creating validation protocols (prototypes, experiments, economic tools) that can be used as milestones for the project; and iv) defining explicit design languages that are shared by diverse groups of actors. Such a system of consistent design rules is known as a design template. The literature indicates that rule-based design is the most efficient way of organizing design processes in a stable situation, i.e., for existing products and markets. However, when new innovations are introduced or new social values adopted, one or more of these dimension may be destabilized and render rule-based design ineffective. The design process changes to innovative design when goals, division of labor, validation protocols, or design languages have to be reconsidered.

Innovative design seeks to integrate knowledge and actors into a coherent concept and project that bring value to the firm. Innovative design is not an objective in and of itself but a temporary state in which new models and rules are invented. Ultimately, with the routinization of an innovative design, a new rule-based design is expected to emerge. A topic of great interest within this literature is how actors produce a new set of design rules and tools in the course of a project, i.e. how they generate an innovative design template.

Eco-cities and sustainable construction are, by their very nature, disruptive of rule-based design. The introduction of sustainability criteria provokes a redefinition of traditional performance criteria for urban planning. For instance, the economic objectives are different, and architectural integration, social diversity, safety, transport, low energy consumption and the use of buildings have to be taken into consideration simultaneously during the construction process. There are also uncertainties related to the kind of expertise required to build an eco-city and to the very labelling of such initiatives as eco-cities/districts, sustainable neighbourhood, etc.

Sustainable construction illustrates a domain in which significant changes are affecting the four sets of rules, hence calling for innovative design. Actors are also recognizing that the accumulation of different 'best technologies' or 'best practices' does not necessarily lead to a coherent concept that produces increased value for clients and for society. The simple adoption of new managerial systems and label does not generate a new design template; a more complete revision of design rules is required to achieve that goal. In addition, design templates are difficult to import and replicate from other countries because they are incomplete,

cognitively embedded in local routines, inclusive of local modes of collaboration, and dependent on tacit knowledge. Hence, significant work is required to turn an innovative design into a new design template.

THE RELATIONSHIP BETWEEN INSTITUTIONS AND DESIGN REGIMES

Innovation does not develop out of an institutional vacuum. Institutions play both an enabling and constraining role on innovations. On the one hand, standards and reference systems can help innovations become systematic, explicit, communicable and transferable from one context to another. Institutional structure thus enables the formulation and diffusion of an innovation. On the other hand, institutions create path dependencies in innovation processes by means of the legal system, professional codes, language, and cultural codes (Garud & Karnoe, 2003). As a result, standards and reference systems can play a constraining role on innovation; They can make certain innovations possible and others impossible. In a highly institutionalized context, innovations may be rejected because they appear to established actors to be radically different, perhaps even incomprehensible, making new entrants suffer from the 'liability of newness' (Aldrich & Fiol, 1994; Stinchcombe, 1965).

An exploration in greater detail of the relationship between innovation and institutions requires a well developed understanding of innovation. The distinction between the two design regimes, namely 'rule-based design' and 'innovative design' (Le Masson et al., 2006) can help specify this relationship. Rule-based design is characteristic of situations where actors play within already established value sources, performance targets, and identifiable coordination mechanisms for expertise, project management, etc. This situation is typical of highly institutionalized and regulated contexts, where the state and professional groups have a strong regulatory capacity. This situation does not preclude innovation, but embeds it into constraining routines that make innovation converge towards an already dominant design (Anderson & Tushman, 1990). In contrast, 'innovative design' refers to situations of unstable value sources, new and unexplored business models, and new coordination tools and expertise (Le Masson et al, 2010). Such situations are closer to what is sometimes referred to as radical innovation, i.e., where dominant design and technologies are rejected in favor of new ones and where the product is entirely redefined in the process. Innovative design can be highly disruptive for actors and also controversial because expertise, performance criteria, and business models are challenged in the process. Such situations can destabilize the existing institutional framework at cognitive, normative and regulative levels. Below a comparison of the two different design regimes and their relationship with institutional context in which they develop.

	Characteristics	Type of innovation	Relationship with institutional context
Rule-based design	Stable value sources, performance targets, validation procedures, and coordination processes.	Predictable and path-dependent. Innovation converges towards a 'dominant design'.	Compatible with a highly institutionalized context, i.e. stable performance metrics, laws, established professions and expertise.
Innovative design	Reconsideration of goals, division of labor, validation protocols, or design languages.	Radical and disruptive. New path creation, exploration of new value and expertise.	Disrupted institutional order, on-going institutional change, and institutional vacuum.

What kind of institutional action / framework is likely to support innovative design processes? Is institutional action meant to sustain innovative design logic, or forces a fast return to a rule-based design logic? In particular, what is the role of standards and reference systems in this process? Are standards and reference systems only leading to isomorphism in an organizational field, or is it possible to identify a different logic in the development of standards, that would be more adapted to the institutional issues associated with innovative design?

Our research should offer a relevant empirical setting to investigate these questions for two concomitant reasons. Firstly, eco-cities and sustainable construction are, by their very nature, disruptive of rule-based design. Secondly, there are a large amount of initiatives to develop standards and reference systems in the field of ecocities and sustainable construction.

METHODOLOGY

Our empirical study is designed as a comparative case study. Cross-national and case study comparisons are particularly useful for illuminating the emergence of new design templates. They can shed light on processes of innovative design and on the translation of design templates imported from elsewhere, and thereby explain why two countries develop different design templates for sustainable construction even if they attempt to imitate best practices from abroad. A comparative design increases the robustness of findings. In contrast, single cases have a tendency to become idiosyncratic and to not lend themselves to generalization. More specifically, we compare sustainable construction in Denmark and France. The construction industry in these two countries is interesting to compare because they are both subject to EU legislation and to fairly expensive state engagement. These similarities make for a solid comparison of innovative design processes.

Case selection

We have selected two types of sustainable construction cases in the Danish and French construction sector. One of them is eco-cities (or eco-territories/ eco-districts); the other is refurbishment of social housing. Eco-cities represent a new domain of activity, hence open for innovative design. In contrast, social housing is a highly regulated domain that has become institutionalized over the past 40-50 years, for which reason we expect it to be subject to rule-based design. The two domains sometimes overlap, notably in situations when the establishment of an eco-city includes the refurbishment of existing social housing. We have identified a large number of cases in both categories (see appendix 1). From these lists we have selected in-depth case studies. The selected case studies were chosen according to two criteria: their innovation potential and their degree of completion. The latter determines whether we conduct a retrospective or an in-situ study, which respectively optimize the assessment of value or the details of the processual data we can collect. For the present explorative study we have selected a small number of cases:

1. Standardization initiatives: *Realdania Arealudvikling* and *Green Building Council* in Denmark, and *HQE2R*, *HQE Aménagement*, *MEDDEEM*, and *Afnor* in France.
- 2.a Innovation initiatives - eco-cities: *Amager Øst* in Denmark and *Grand Large* in France. These projects are already partially achieved, making a retrospective study of innovation possible.
- 2.b. Innovation initiatives – social housing: *Paris Habitat OPH* in France. This project represents both on-going and already achieved project of refurbishment of social housing in France.

A short description of the selected cases is presented in appendix 2.

Data sources and data collection

The data sources used for studying the standardization of eco-cities include reference systems (i.e., assessment grids), observation of meetings, and semi-structured interviews with key actors. We collected reference systems for eco-cities in both countries and identified actors who took part in the development of each reference system. We conducted a total of nine semi-structured interviews with these actors during March and April 2010, three in Denmark and six in France. To assist this data collection, we used an interview guide that explored the origins, current status and future prospects of each reference system (see Appendix 4). Interviews lasted between 45 min. and two hours, they were recorded and transcribed. In addition, we observed a small number of meetings where a reference system was being discussed or presented.

The study of innovative design processes involved the following of work processes from the early beginning of the conception or planning phase to the formulation of a sustainability innovation of higher value than

business as usual. We conducted ethnographic observations, interviews, and analysis of new design tools to deepen our understanding of the work processes. We collected data on innovative design templates through three data sources: a) formal documents describing which actors, technologies, and work process relate to the design of sustainable buildings, 2) observations of which actors, technologies, and work process are evoked during the design of a new building, and 3) in-depth interviews with actors involved in the design process. In the course of data collection, we focused on the innovative elements that became defined and materialized as sustainable and of high value and the processes that seemed to have led to these innovations. This data collection provided insight into fine-grained processes is difficult to access through retrospective study.

Data analysis

To analyze the reference systems and associated interviews, we first developed individual spreadsheets for each reference system and interview. We then inserted key data material from the individual spreadsheets into comparative tables (reproduced in appendices 5 and 6). Based on these comparative tables, we identified commonalities as well as differences in the eco-city reference systems that are taking form in Denmark and France. These analytical results are presented in the next section. A similar analytical process was followed for the study of innovation in the eco-city projects and sustainable social housing projects.

FINDINGS

In this section, we present the first results relating to the emergent standardization of eco-city reference systems (question 1) and to processes of innovation in eco-city and sustainable social housing projects (question 2). Since our data collection was preliminary, the results are tentative and the study explorative.

Question 1: Standardization of eco-city reference systems

The content of reference systems

We identified four fairly developed reference systems, three in France (MEDDEEM, HQE Aménagement, and HQE2R) and one in Denmark (Realdania Arealudvikling), a selection that is not exhaustive. A summary of their content is reproduced in Appendix 5. Other reference systems are under development and are covered as such in a subsequent section. We compared these four reference systems and found some interesting trends in terms of their scope (i.e., area of applicability), the themes and indicators they use, their ultimate objective, their embeddedness in other reference systems, and the form of output they produce.

The scope varies from the construction of new cities that are sustainable from the start to the renovation of existing cities to make them more sustainable. Some reference systems are developed specifically for the former goals (e.g., MEDDEEM) while others orient themselves toward the latter (e.g., HQE2R). A number

of them aim to be applicable to both new and renovated cities (e.g., Realdania Arealudvikling and HQE Aménagement). Naturally, the content of the reference system differs somewhat depending on the scope. For instance, it makes little sense to evaluate the extent to which the eco-city preserves the local patrimony if the eco-city is being constructed on empty land. Likewise, the energy efficiency of buildings can be much higher if the city is newly constructed than if the buildings in an existing city are very old. We see differences in the scope of the identified reference systems, but we cannot ascertain whether there are national tendencies at play.

As for the elements and indicators used, we see some interesting trends across reference systems. First of all, most of the reference systems use as their basic structure a classical division between environmental, social and economic dimensions of sustainability. One of them (HQE2R) diverges from this classical division and introduces instead a number of cross-cutting themes that seem to exclude economic factors. When we compare the indicators used in the different reference systems, i.e. the more specific formulation of what elements are being evaluated, we find a certain number of standard themes that cross-cut the reference systems. Most of these standard themes belong to the environmental dimension, namely energy, transport, water, and waste. Only one, diversity, is common to all reference systems in the social dimension. There is otherwise significant variation in indicators across reference systems, although some indicators are used in several but not all reference systems. In the environmental dimension, we see landscape, bio-diversity, patrimony, and construction materials. In the social sphere, where it seems particularly difficult to come up with universally applicable indicators, we notice a tendency to include local governance, health, access to employment, and education and training. Finally, there is a tendency in the economic dimension to evaluate the costs of the project and the local economic performance, though the latter seems rather ambiguous and difficult to assess.

In terms of their ultimate objective, we find an interesting dividing line between reference systems that aim toward a performance rating of eco-cities and reference systems that seek to certify work processes. For instance, some reference systems let the actors select which themes and indicators they want to work with (e.g., HQE2R and HQE Aménagement) while others insist on using the established indicators (e.g., MEDDEEM) or at least the identified themes (e.g., Realdania Arealudvikling). Not surprisingly, the most flexible reference systems are oriented toward a certification of the work process like an ISO certification (HQE2R and HQE Aménagement)) while the more fixed reference system pursue an assessment of eco-cities as a sustainability product (MEDDEEM & Realdania Arealudvikling). Clearly, the reference systems vary according to what they first and foremost seek to standardize: product or process.

As for their embeddedness in other reference systems, we find that some reference systems have been embedded in existing reference systems, such as ISO standards, national norms, European norms (HQE

Amenagement and MEDDEEM) to which they make frequent reference, while others refer only to minimal national legislation (e.g., Realdania Arealudvikling). There may be strategic elements at play in this choice.

Finally, as for the output, we note that all the reference systems use subjective evaluation criteria. To measure performance, several of them have a quantifiable rating system that rely on scores between 0 and 3 (Michelin-inspired) stars (MEDDEEM), between 1 and 5 (Realdania Arealudvikling), or between -3 and +3 (HQE2R). HQE Amenagement has no quantifiable rating system but engages actors in the setting of specific goals that can be integrated into a contract. The three quantifiable reference systems use 'spiderwebs' as a graphic illustration of eco-city performance, some of which add weight to the different dimensions to calculate a score (e.g., Realdania Arealudvikling), others of which formulate an action plan to facilitate further work (HQE2R). Clearly, the output is tied to an ambition of eventually carrying out a certification of eco-cities (e.g., MEDDEEM) versus a desire to achieve a specific result for the contractor (e.g., HQE Amenagement). The output determines to a significant degree to which end the reference tool can be used.

Process of standardizing reference systems

In this section, we highlight some of the key findings under each of the themes explored in the interviews. We conducted interviews also with actors who had not yet developed a reference system, or where the reference system is currently under development.

Theme 1: Origin of the reference systems

One question is when the two countries started developing eco-city reference systems. In fact, all the identified initiatives have been developed recently. Only one, HQE2R, which was launched at the end of the 1990s, is more than five years old; the five other initiatives are less than three years old. We note that France seems to have started earlier than Denmark on developing reference systems for eco-cities.

Another topic of interest is their sources of inspiration, i.e. whether the actors build on specific eco-city projects in Europe, such as Vauban in Freiburg (Germany) and Bedzed in the United Kingdom. We find no mention of previous methodologies in the field of eco-cities, and no reference to specific exemplars as sources of inspiration, yet the actors mention that they wish they had methodologies for urban planning:

"Sustainability has been a growing issue, [but] it has not been so detailed regarding sustainable urban planning. It has been a discussion, what you call it, some headlines ..., so when I came here for 2 years ago, we started discussing how we could go further down into details regarding how could we handle sustainability in development in urban planning specially urban development ... and we found out that there was not that much about it. You could find sustainability, sustainable tools or what you

call it, talking about buildings ..., but talking about urban development it was much more...it always came back to the building ..., between the building and so on was more a black box.... So we have tried to, together with some consultants, to find out how could we attack the problem, how could we attack the, to get some tools that we could use easily” (Realdania Arealudvikling)

“When we looked at initiatives abroad, initiatives were at the local level, there was no standard, we were surprised to discover that there was no methodology which could be applied at the national level. And Leed and Breeam were only acting at the level of the single building”. (HQE Aménagement, I.Baer)

We note, thirdly, that the actors engage in one of two different approaches to the development of reference systems: either a network perspective or an individual development process. The first one, a **network perspective**, enrolls many major actors from the national context in the development of the reference system. This approach is illustrated by Statens Byggeforskningsinstitut (SBI) in Denmark, a public organization engaged in construction research, and HQE Aménagement in France, which is a subdivision under HQE, a private organization with roots in the public sector. Both of these initiatives have involved multiple national players in the development of their reference system so as to increase its change of adoption, diffusion and institutionalization within the country. For example, the SBI initiative involved major Danish engineering consultancies (COWI, Rambøll) from the very beginning of setting up a Danish Green Building Council. They have devoted significant effort to assembling both private and public actors from across the Danish construction sector to participate in the choice and adaptation of an international reference system for eco-cities, probably inspired by BREEAM or LEED. This adaptation is planned for the second half of 2010. The initiative is financed by members of the steering group, composed of the initiators and large commercial producers. An actor from SBI explains the process of development in the following words:

“But then later in the 90’s there was an interest, especially amongst the consulting engineers to do something on these areas dealing with green buildings and that was established a rather big project called something like environmental management of the design process.... But that project did not include any certification system like BREEAM or LEED. It was an open system and the idea was that in the beginning of the process the consultant together with the client makes a kind of map showing where the potential environmental impacts are related to these new projects[] it was first of all made for private clients or governmental or municipal clients but it was first of all meant for the person to person discussion, not, I don’t think that it was discussed very much to how to include a larger public [] lots of money was spent making these guidelines and using these guidelines for demonstration projects, but afterwards it was not used very much. [] And the authorities who had spent lots of money

on these projects were not very satisfied with that. A few years afterwards we discussed with some, one big engineer firm and one big architect firm to take a step towards Danish certification system, we made a pilot model for that [] and we used it for a few buildings but... it didn't succeed... you have to involve a number of people who wants this; you have to have marketing and things like that." (SBI)

Likewise, the French HQE Aménagement® standard was first initiated and financed by the National Syndicate of Housing Estate (SNAL). It was later integrated into an internal project on urban planning initiated by HQE. The HQE Aménagement project benefits from political support from major institutional actors in France: Ademe (a national agency for energy and the environment), CSTB (a public body responsible for the technological dimensions of buildings), CICF (a professional association of engineers), FEPEF (an association of local public companies), UNSFA (a professional association of architects), SNAL (urban planners), the social housing union, and state representatives.

The second approach, the **individual development** orientation, refers to a single actor, most often private, who takes initiative to develop and/or promote its own reference system. Individual development means that actors seek to systematize their own methodologies, communicate about them, develop business partnerships and thereby enhance their legitimacy as urban planners. This approach is illustrated by Realdania Arealudvikling in Denmark and HQVie/ Eiffage in France. Below an account of both of their developments:

"[Realdania Arealudvikling] is a daughter company of Realdania, and we have more or less worked with this alone....We had these two projects, Køge and Fredericia, where we knew that we had to go into sustainability. That was an issue in the developing of these projects; they HAD to be sustainable. [We have had] some experience [on sustainable urban planning] and we have made it better. And as a first step I hope that we maybe could put in on our homepage, in some way so that people or municipalities could use it when they are discussing urban development with part of their municipalities or their city." (Realdania Arealudvikling).

"Through HQVie®, we want to show the maturity of Eiffage regarding sustainability, and differentiate our offer as urban planners, but also at a lower scale [i.e. the building]. What we propose is a common ground, a common culture on sustainability. Through HQVie®, we create and share a common language on sustainability in the field of urban planning.... We did not want a standard or a label, this was clear from the beginning. It is rather a methodology; we call it a reference system because it is the most neutral term. Many people ask us whether there should be a label, but we would not like that." (Eiffage sustainability officer)

"The project has enabled us to develop new business partnerships. For example, I spent three hours today with Lafarge and they would like to work with us on the concept of modular buildings with new

materials that are carbon-free, light, easy to produce at a large scale, and with high soundproofing characteristic, and a neutral carbon. Likewise, we met GDF Suez, RATP and these counterparts find a great interest in our project". (Eiffage sustainability officer)

HQE2R also represents an individual development approach within France. Initially developed as a research project financed by the EU, CSTB and PUCA, this reference system lost formal political support and became marginalized in the field because of personal conflicts between its initiators and representatives from CSTB and PUCA. The initiators withdrew from these public organizations and continue their work to develop and promote the reference system as a private initiative.

These two approaches to development do not seem to reflect a systematic difference between the two countries, perhaps as a result of a small number of cases, yet we get the impression that the network perspective may be more widespread in Denmark than in France, regardless of the initial stimulus to create a reference system.

A final – somewhat surprising - observation we make is that the national standard organizations, Dansk Standard (DS) in Denmark and Afnor in France, do not appear to be particularly active in the development of eco-city reference systems. In Denmark, DS is not involved in any reference system for eco-cities or urban development, and they have no norms currently under development in these areas. Their main area of concern is norms for buildings and building parts, some of which are made mandatory in *Bygningsreglementet*, the Danish building code. In France, Afnor tried to initiate a reference project on eco-cities but failed to get support from some key participants, notably architects who contest their traditional technical focus. Afnor is also not strongly integrated into construction networks, which makes it difficult for them to take such an initiative.

Theme 2: Current status

One issue that emerges in the interviews is an uncertainty about which performance criteria to use. In both countries, actors acknowledge that the definition of performance criteria is a difficult task. In all initiatives, the environmental dimension and the elements related to the building itself were easier to define than the social and economic dimensions and the elements associated with urban planning. The more difficult elements were added later to the reference system in several projects. As explains one actor:

"The five environmental elements are rather easy to find because talking about buildings and talking about environment, these are easy- energy, transport, water, and so on. So, this is the easy part of the

work. But when we come down to the social-health dimension, it's much more, when you talk about the urban development projects I think it's much more difficult to find out what is the element and after that what are the indicators and what do you ask about and how do you measure, so that part has been really difficult, and I would say the same for the economic dimension” (Realdania Arealudvikling)

In fact, performance criteria remain poorly defined in several reference systems, and some projects, e.g., HQVie/ Eiffage and HQE Aménagement, will work on this topic in the near future.

A related problem pertains to contextual specificities at the district/city level, the regional level, and/or the national level. One actor explains how they proceed to take the national context into consideration:

“We started with some international consultants, we started with Ken Young, who is a very famous architect, but that was again about putting green on the walls, on top of the roof and so on. That could be sort of sustainability for the environment in the urban part of town, but that was not exactly what we wanted to do. Then we have been discussing it with a big engineering firm [with experience from Shanghai]..., but we found out that if we should have a good tool we could use in the daily work, we had to be in a Danish context. We had to start there, talk with some consultants who understood the Danish way of thinking, the Danish way of doing urban development, so that is why we want back to a firm in Denmark.” (Realdania Arealudvikling)

Work is still under way for many actors in terms of making the reference tool applicable to different contexts within the country.

A second element of interest is the different orientation we note in Denmark and France toward international versus national standards. LEED (American) and BREAM (United Kingdom) reference systems seem to be a more important reference in Denmark than in France. In Denmark, reference systems were initiated as a need to adapt existing tools to the Danish context. This was one important reason for Realdania Arealudvikling to develop its own methodology:

“We have been thinking that when you make a BREEAM UK, you have some questions which are totally different from the situation in Denmark, specially also in US with LEED there are some other questions which are much more, they have much more well...cars and discussion of going from car to bike are much more difficult for them than there is for us, for instance, and so on. I think you have, I think that, well that could be some of your research. It's difficult to translate... this to a national, no international scale. It's easier to do that with a building – in a way.” (Realdania Arealudvikling)

“...also BREAM and LEED, ... it’s too...you don’t have to make it that difficult... Its actually when you are talking about sustainability for urban development don’t make it too difficult, keep it simple, specially because when you have the broad discussion of sustainability with healthy sustainability and the economical part and so on, I think you have to try to make it easy, to make it simple, to answer some questions.” (Realdania Arealudvikling)

Following the same logic of adaptation/translation, SBI has plans to translate BREEAM or LEED into a Danish context after a methodology has been chosen, probably in the second half of 2010. In contrast, France seems to be more influenced by former national standards. In particular, HQE® has become a central and legitimate reference among construction actors in France, making it attractive to include HQE in the title of French eco-city reference systems. The eco-city reference system being developed at MEDDEEM is also given special attention because it is led by the French ministry for sustainability. International or foreign reference systems such as LEED and BREEAM and CASBEE are well-known in France but they are apparently not an object of either adoption or translation in France.

With local collectivities, we want to enter via HQE®, everyone asks for HQE®, but through HQVie® you can do both, in fact you do more than HQE®. It is a sort of Trojan horse if you like. [But]... we also wanted to create distance to the optional logic which prevails within HQE [the ability to select some indicators and disregards others which may be more critical in terms of sustainability], which we and our contacts consider completely counter-productive. Everyone in the sector is shocked by this approach. (Eiffage)

“Local collectivities were asking us to develop some HQE urban planning programs, and some actors were beginning to say “we have an HQE district”, and that is how HQE Aménagement was initiated, the association wanted to keep a tight control over the methodology.” (I. Baer, Snal)

In France, there is less interest in adapting existing international or foreign reference tools to the local system and more interest in developing brand new process tools for sustainable urban planning. For the interviewees, this orientation requires a systemic and encompassing perspective that is currently lacking. For instance, HQE2R has a clear focus on renewing urban districts while all the other French reference systems adopt an all-encompassing and systemic position. HQE Aménagement presents itself as a quality framework distinct from the Management System of the Operation (SMO), which details actors, stages and associated actions/decisions. Hence, clear distinction to other reference systems, be they French or foreign, seems to be a priority in France.

Theme 3: Future prospects

The future prospects of a reference system refer to the likelihood that it eventually becomes a frequently used national reference for eco-cities. It is, however, rather difficult for actors to judge the development potential of their reference system. Most reference systems are still under development or just issued, and little knowledge is available about their current users. However, their diffusion may differ in the sense that some reference systems were simply not designed with the ambition of developing labels and mandatory standards. This is particularly true for private actors, such as Eiffage and Realdania Arealudvikling.

There are different options about the very idea of certification and standardization. A number of private actors express hesitation to support such initiatives, while others embrace them whole-heartedly. Realdania Arealudvikling has no ambition along those lines:

“We will not open for a certification. I don’t know if anybody will.... I think what we are talking about – urban development – it’s VERY difficult to make a certification. Because we are already busy discussing, and you’ll see with the go from Køge to Fredericia, ... we expect to see that we have some different questions because the situation and the geography is different....You can put wind turbines around Fredericia, but it is difficult to do so in the center of Copenhagen”. (Realdania Arealudvikling)

Some of the French actors are more eager to include certification. HQE Aménagement, for instance, adopts the idea. While recognizing that the reference system should not specify technical solutions and that objectives must be defined at the local level, several actors involved with HQE Aménagement think that a label could be granted to certify the management system. HQE has already adopted such an approach for the building.

“At first, we will certify the management system, and we are now beginning to work on the ability to measure quantitative indicators, energy use and consumption, water, density (which is an important dimension in the context of the Grenelle). [...] The reference system is absolutely not frozen into ice. Today is only a first stage, it is an iterative process, in a quality and progress logic. Some new items and issues will certainly appear during the process” (I.Baer, on the HQE Aménagement reference system)

Another approach to diffusion is to encourage the adoption and use of the reference system across the construction sector. As mentioned previously, the involvement of many different actors in the development of the reference tool represents one such avenue. Within the Danish context, SBI appears to be more likely to institutionalize their reference tool than Realdania Arealudvikling because of its greater effort to gather support from the various stakeholders within the building sector and to connect the reference system to international initiatives. Their argument is that the Danish market is too small for multiple reference tools:

“My feeling would be that...in the future, there will be a number of systems competing with each other... we are living in a market society. But because Denmark is that little from an economic point of view, not many people, if they have adapted one system to the Danish context, and it's a broadly accepted...then I think that it will be difficult for others to raise money for adapting another system to the Danish context...” (SBI)

In France, there is variation in how much the different developers of reference tools have tried to involve stakeholders. HQE Aménagement has sought to gain a first mover advantage by involving all major stakeholders in the initiative and by leveraging the success and legitimacy of its ‘mother’ label HQE®. From this point of view, HQE Aménagement appears as the most likely to institutionalize within the French context. A critical element resides in its ability to get recognition from the Ministry, where MEDDEEM’s own eco-city initiative represents a direct competitor.

“There is a strong amount of work ahead of us, both political, on communication, network building and on the methodology to prove its quality, but I think that HQE Aménagement has all possible chances to spread and become a widely used and recognized tool, as soon as there is a good articulation with what the ministry does on ecodistricts, that a good communication is made towards local collectivities, and that good communication is made. There is no big reason why it should fail. I think that the methodology has good changes to impose its mark on the landscape, but then we need to move fast because demand will be very strong on labellization. And we need to keep an eye on international initiatives as well, make the reference system evolve in order to be in tune with actors expectations and other initiatives in the field. I would find it very sad to see 36000 uncoordinated methodologies burgeoning in the landscape. There is a risk that each city develops its own referencesystem, that the Ministry develops something else and other public bodies their methodologies and standards.” (I.Baer, QHE Aménagement)

By contrast, HQE2R has little chance of diffusion along these lines since it has become somewhat marginalized within the French context. Eiffage (HQVie) do not wish to spend too much energy in promoting its label to the French State and hence does not have excellent prospects of diffusion through this channel. Instead, Eiffage tries a different channel: it limits national communication, promotes communication to important local constituents, and tries to obtain international recognition that can be used as a lever in France.

A final strategy for diffusion is one of having the reference tool, or parts of it, become integrated into national legislation, i.e. made mandatory. This avenue can go through EU legislation, e.g., through lobbying

activities, or it can directly influence the national building legislation. Changes can have significant and rapid impact on practice in the construction sector, more so than certification and other voluntary adoptions:

“But next year we will have moved a lot [relative to the standard today] because the new Bygningsreglement will change dramatically.... It has been decided by the government to reduce the energy consumption of buildings... I think there is a very great interest in reducing, or strengthening the demands for reducing the energy consumption....I think that the experience is that whenever you change Bygningsreglement, then something happens. It happens quicker than if you make a certification.” (Dansk Standard)

Both Denmark and France are currently engaged in a revision of the national building code. Some construction actors are involved in this process and hence have the potential to influence the formulation of the revised building code. In Denmark, Dansk Standard plays an important role in this work. There are, however, no initiatives as yet that pertain to the urban planning level, let alone eco-cities.

Reference systems and innovation and design regimes

To what extent do standardization initiatives and reference systems support or hinder innovative design logics in the field of ecodistricts?

Many actors who initiated reference systems or standards in the field of ecodistricts are well aware of the difficulty to rigidly define performance standards and adopting a too rigid approach on this question. Actors recognize that objectives are hard to define ex-nihilo and should be context specific, and are careful to preserve a wide diversity of projects using the same reference systems. The focus on process tool (rather than technical solutions and performance standards) and on the identification of broad themes is a way to deal with this issue.

“What I find particularly interesting in our methodology is that we do not define a-priori what good urbanism is.[...] It would be like prescribing what good art should look like. However, in my personal opinion, we need to do more on indicators, performance indicators. But this is a very sensitive issue, in particular for architects and urban planners. We need to leave creativity into the process. But we can identify a good way to work, an approach, a logic for raising appropriate questions at the right time, the necessary competencies that need to be brought into the project, these can be defined at the upfront. But what is vital is to maintain a wide variety among projects. HQE Aménagement is only a tool, which provides some help in the design and decision making process, but in the end, you can use the tool and get a poor performance, because performance relies on people and their skills.” (I.Baer, on the HQE Aménagement reference system)

“what they [local collectivities and urban planners within Eiffage] find particularly attractive is our ability to combine a global, systemic perspective with a flexible reference system, that is completely respectful and adaptable to each local context. This is truly fascinating. [...] I believe the most critical is to say: “the problem is to understand your needs and build a project according to the methodology principles. We will find the corresponding technical solutions afterwards. Technology is only a support, it is a secondary issue” (Eiffage, HQVie)

For Eiffage, the reference system is first and foremost a tool for formalizing and extracting the underlying principles of the internal R&D project Phosphore. The tool is both a way to explicit and structure Eiffage’s approach to the development of ecodistricts, and a tool for organizing interactions between the company and its clients.

“The idea was to explain the approach, there were so many things within the project that we really needed overarching principles to share with our clients, to agree on what you need to look at when designing an EPHAD, social housing facilities, a high school or whatever. We extracted the fundamental principles that you need to take into account to be in a sustainability perspective. [...] The idea was to extract the very essence of sustainability, in terms of environmental and social dimensions” (Eiffage – HQVie)

It is also noticeable that the Eiffage tool is a way to designate, communicate and explore innovation fields within the firm and with its clients. The first section of the reference system regroups 6 overarching principles that are meant to guide and structure decisions regarding the design of the ecodistrict on the key domains. Over these 6 principles, 5 play the role innovation fields for the firm. These principles were particularly useful to make sense of existing technical innovations within the firm and in its communication towards its clients.

“Our six principles enabled us to go beyond a logic of patchwork-innovation, with no internal hierarchy and priority, and scenarize what we do into a more coherent whole. We found solutions, sometimes already developed within the group, but which had never been used that way. By doing this, we gave a second life to existing concepts (such as Luciole) which could be integrated into wider concepts (Rue nue) which made sense into wider principles (adaptability of the solutions, energy efficiency). When we presented this to the Presidents, they said: here we have something which makes sense. Because typical industrial groups have a catalogue for classical solutions, another catalogue for sustainability solutions, and the two appear as a patchwork. For the first time, we put this into a coherent whole, a scenario, and for the first time, it had a sense, it became meaningful, both inside and outside the firm.” (Eiffage – HQVie)

Public actors are in a more usual “command and control” perspective about standard development and take their distance with the former approach. This is the case for the Meddeem initiative and its willingness to develop a reference system about ecodistricts, with a willingness to develop more refined and stabilized performance indicators.

Question 2: Innovation in eco-city and sustainable social housing projects

We identified three different innovation processes, two in France (refurbishment of a social housing tower in Paris (Tour Bois le Prêtre) and an ecocity (Grand Large)), one in Denmark (the Amager ecocity). A summary of their content is reproduced in Appendix 6. Other innovations are under development but are not considered in this article.

This section is seeking to highlight the characteristics (concept, knowledge and processes) that differentiate emerging new models of innovative design from historically and institutionnally situated one. The underlying assumption is that there would be some new innovative design regimes related to sustainability that are under and that substantially differ from conventional, rule-based design forms. For that purpose, we tried to stick in a first stage to the individual level of innovation practices (projects) by looking at all the significant changes that can be identified at three levels: the underlying concepts, the knowledge and actorhood and the processes. In a second stage, we will study carefully to what extent are these practices likely to freeze into new set of rules that are institutionnalized.

A brief historical background on innovation in social housing and urban planning in France and Denmark

Innovation is not a new phenomenon in the construction industry. Recent historical periods have been characterized by different models and practices of innovations that have been sometimes incorporated in design rules and templates and other times denied or rejected these innovations. As one of one interviewee said, “*social housing has always been a laboratory of innovation in France*”. It has been a domain where new techniques (concrete, prefab, etc.) have been experimented at large scale, where architects and public authorities with new ideas have experimented new concepts of modernity.

Urban planning has also been a domain of intensive innovation. The profound transformation of Paris (both architectural and circulation) initiated by the Baron Haussman between 1860 and 1870 is a prominent experience and leading experience. Another is the emergence of a modernist view of urban planning and architecture, first 20's (the Athen charter set by great Architects as Le Corbusier) and its successive one after world war II and during the period of economic growth, urban planning was also an object of intense innovation, especially framed by a “modernist approach” in which new urban areas were designed from scratch based on new urbanistic and architectural views (see the Delouvrier plan who set the urban planning policy in France in the 60's).

Social housing and urban planning are closely interconnected phenomena since social housing is, most of the times, a key dimension of design (or renovation) of new cities. What differentiates the former from the latter is the scale of design (the building, a group of buildings and its immediate surroundings for social housing ; the district or city with its different functions (housing, transport, waste management, etc.) for urban planning).

Value-driven concepts of sustainability

The first and most easy way to appreciate the degree of innovativeness of different design projects is to focus on the expected value of concepts – its ambition, its coherence, and the underlying conception of performance. The three projects claim to be based on disruptive concepts but differently from what is usually presented.

Sustainability does not mean an outstanding technical performance. It is rather a matter of integrating different innovations within a coherent concept that improves living conditions.

Social housing was traditionally a place where new techniques were experimented. The initial building whose refurbishment is here studied (Tour Bois Le Prêtre) was built in 1958. The initial concept (build a “modern ensemble with high level of confort for lodgers” said the initial program) was technical performance oriented. It was meant to demonstrate the technical skill of the architect and of engineers, experiment new techniques (prefab elements on a concrete vault for building different towers).

The first refurbishment project, carried out in 1990, was also technical-oriented. It was not especially innovative – but was representative of social housing rule-based design of that time

whose dominant concept was to design “**insulated buildings**” with renovated facades. This concept was mainly driven by **energy efficiency and soundproofing targets** to respond to new public incentives on energy efficiency regulations and incentives that emerged as soon as the mid seventies (after the first oil crisis). According to our interviews, this concept has become dominant in 1980’s-1990’s in France, especially in the OPAC HLM Paris that manages a stock of 120 000 housings in Paris and its suburbs. Environmental and economic performance was to be achieved by generalizing at large scale new technical components like double glazing, internal and external insulation systems.

The refurbishment concept finally selected in 2005 rejects the demolition-reconstruction of the tower (that was proposed by other actors). After a consultation of the lodgers and life cycle analysis, the decision was made to transform the existing tower and to demonstrate that “equivalent performance can be achieved at lower costs than demolish and rebuild” that provoke nuisance and costs. The project includes a complete internal transformation of the tower (reagency of rooms, design of collective spaces, luminosity, etc.) with the objective of improving the living conditions of lodgers. Similarly, the “Grand Large” and Amager ecodistricts concepts are not associated to any spectacular technical achievement. Attention is given on “**living conditions and social mixity**” (Grand Large), on “**CO2-neutrality**” based on a “holistic approach to urban development” (Amager) which do not suppose any complex technical innovation.

Sustainability is not here associated to a particular aesthetical vision.

The sustainability objective shall go beyond a necessarily ephemere approach of aesthetics. It is achieved by integrating a combination of different innovations but with nothing spectacular for an external observer. The transformations achieved are internal and mainly visible for inhabitants. The architects selected for the refurbishment project in Paris claim an “aesthetics of the ordinary”. They experimented this vision in other projects and theorized this approach in a document for the ministry of housing. In the “Grand Large” case, the buildings recall the traditional Flemish aesthetics with crenels but it was also selected because this architecture minimizes the energy dissipation. In the Amager ecodistrict, primary attention was given to the program’s performance and functional requirements.

Sustainability concept here involves an holistic approach and life cycle thinking which are intended to give higher value than environmental, social or economical dimensions taken separately.

In all three projects, sustainability is a promise to give higher value for customers and the stakeholders at large, value which is measured in a life cycle perspective. Sustainability performance is not reduced to one specific indicator even though specific targets are put forward (CO2-neutral district in Amager, sustainable social mixity and energy consumption of Grand Large, conditions of living for Tour Bois le Prêtre).

All three programs insist on developing an holistic approach where different dimensions are taken together. In the social housing refurbishment project, The enrichment of the performance criteria was concretized in the setting of a sustainability guidelines for the OPAC Paris that consist of a 17 performance targets guidelines that was used to compare and select the proposals made by respondents (architects-engineers) during the call for tenders.

Improving “living conditions” is in the social housing case study seen as a progress with compared to the previous refurbishment carried out in 1990 that was primarily oriented towards energy efficiency and soundproofing but which proved to have a number of unexpected outcomes (degraded collective spaces, poor comfort, etc.).

The Amager district depicts a city that should be “green, clean and healthy”, “a good city to live and move around him”. Performance targets include energy supply, waste, water, transport, infrastructure planning, behavior and consumption of goods.

In all three projects, focus is put on the coherence of the concept and the integration of multiple, yet contradictory performance criteria, and its evolution during its life cycle.

They also argue that sustainability objectives encompass financial sustainability. This belief challenges, of course, current views of professionals and the media that consider that sustainability should incur higher design and construction costs.

Knowledge integration

Exploring this holistic and life cycle concept was made possible thanks to the development of new knowledge (tools and expertise).

Developing life cycle methodologies

First, a first series of expertise deals with life cycle thinking. The approach was qualitative and included some kind of multicriteria analysis and system modelling. This system approach helped to

compare the different proposals in competition. Thus, in the refurbishment project, this reasoning was used to eliminate the “demolish-rebuild” proposals that seemed to be common knowledge for most actors and experts but in fact proved to have negative environmental and social impacts in the long run (nuisance for lodgers and the neighborhood) during the demolition phase). In the Grand Large project, long term life cycle reasoning was used in a quite original way: to anticipate the evolution of the population (revenues and age) in the district and adapt the facilities to these criteria. The development of quantitative methodology (like the CO2 footprint in Copenhagen) is however an objective pursued.

Building expertise about integration

The three projects that the project performance is not the sum of local innovations. Therefore, strong design efforts were made in the initial phases to go beyond ‘best practices’ and ‘existing routines’. The choice of the Architect (Lacaton & Vassal) in the refurbishment project was driven because they have acquired a relative fame by theorizing a specific doctrine on social housing in a report to the Ministry of Culture where they present their vision of the improvement of “living conditions”, of integrating different technical innovations in an “aesthetics of the ordinary”. They demonstrated their skill in former experiments as in Mulhouse “cité manifeste”, the first sustainability social housing program in France initiated in 2001. In Dunkerque, environmental expertise and system-like methodologies was developed in previous experiments related to “industrial ecology” which was used to reduce CO2 emissions as the heat of Arcelor steel plant are recycled to provide most of the heating needs of the urban district. In Copenhagen, similar approaches have been developed.

Developing life cycle costing tools

In relation with life cycle thinking and the no extra-cost concept, the development of a global costing method is experimented. In social housing, economic life cycle modelling was used to convince lodgers that higher costs of investment would result in lower lodging charges (heating expenses and water expenses). In Aamager, a detailed financial analysis showed that it should not be more expensive to build and live in a CO2 neutral districts. Cost savings could be obtained but, for that purpose, new design and cooperation processes had to be invented.

Creating sustainability actorhood

Developers played an important role in all projects. Municipalities relied on internal specialized actors and, in the Amager and OPH case studies, also on external sustainability experts. Who helped them to define the program and organize the selection process.

Setting new processes for innovation management

Conventional processes of design are sequential, made of separate stages framed by legal and contractual procedures (architectural competition, call for tender, choice of a developer, contractors, etc.). This sequential process are seen, three situations, as a major obstacle for cooperation, each actor tending to reproduce existing routines as cooperation and efforts in design are not rewarded.

Experimenting new forms of cooperation

To overcome the negative consequences of this sequential, cooperative approaches were experimented. In Amager, the City of Copenhagen engaged in a long term relationships with experts and asked them to identify the conditions for CO2 neutrality within their respective fields.

In the refurbishment project, special efforts were engaged in the design phase. As it was seen as prominent experiment in France, famous architect agencies and engineering firms competed and made special efforts.

Building returns on experiment

All three projects do not measure sustainability performance at the stage of delivery of the building or areas as it was traditionally . Performance encompass maintenance, useage and recycling performance. As the behavior of users is largely unpredictable, these projects include in-situ performance (metrological tools) and qualitative studies to follow the evolution of social needs and environmental performance in the long run. Projects as then viewed as on-going experiments to be conducted and which can have spillover effects for future sustainability projects.

Stakeholder involvement

The three projects have also experimented some new forms of stakeholder consultation. In the Paris refurbishment program, lodgers were involved in the selection process (and voted) and are still associated to the return of experiment. Stakeholder participation and studies are conducted in Amager and Dunkerque.

Replicability of innovations

Tools, methods and returns on experiments were designed to be replicable for other projects. It will be interesting to analyze how this capitalization is concretely organized and achieved as the discourse on sustainability often stresses singularities rather similarities.

DISCUSSION

Our preliminary results reveal some emergent characteristics of the innovative design templates for sustainable construction that are appearing in Denmark and France. However, the data we collected for this paper are insufficient to clearly identify the characteristics of these emergent new design templates. At this early stage of investigation, we can only point to similarities and differences that seem to be forming between the two countries. Let us first consider the question of standardization that we explored in some detail in this paper: *How do actors involved in the construction sector generate standards for sustainability (e.g. sustainability labels, national norms, and reference systems) that shape collective understandings of high value and facilitate the national spread of new design templates?* We identified and compared the contents of four reference systems and interviewed a total of nine actors involved in either the development of one of these reference systems or in ongoing initiatives to standardize sustainable construction in Denmark or France. The results of this comparative analysis point to some cross-cutting parameters as well as to some features that seem to differ from one country to the other.

We have few data points, particularly from Denmark, on the structure and content of the reference systems. It is thus difficult to discern any national differences. However, we found some similarities that are worthy of being mentioned. Most importantly, all reference systems evaluate the environmental impact of water, waste, energy, and transport in eco-cities, and the social impact of diversity. Aside from these five universal themes, the content of the reference systems vary somewhat, though many of them consider the economic cost and impact of making an eco-city and a number of other environmental and social elements. Some variation seems related to whether the reference tool emphasizes newly constructed eco-cities or transformations of existing cities into eco-cities. Our overall impression is that the reference tools resemble each other to a significant degree even if they use slightly different indicators to measure environmental, social and economic elements of an eco-city.

We have more data points for the interviews and hence a better chance of identifying national trends in the standardization processes. Below we discuss two such tendencies: internal national competition and international inspiration. Firstly, regarding the internal national competition, we found that France have started developing reference systems a few years earlier than Denmark and that more reference systems have been, and are developing, in parallel within France. Certainly, France is a much larger country than Denmark, but the division is not regional in any way. Whereas only one eco-city standardization initiative is being initiated within the Danish public sector, France entertains parallel, almost competitive, initiatives within its public sector. The initiating public organization in Denmark, Statens Byggeforsknings-institut (SBI), is a applied research unit devoted to construction. It is mobilizing both public and private actors within the construction sector to take part in the development of an eco-city reference system for Denmark. It is not surprising that this process is somewhat slower than the more competitive, single-actor approach of the French public sector.

Within the private sector, we see more similarities on the topic of internal national competition. There is apparently an interest in both countries in gaining a first-mover advantage and becoming widely associated with the construction of eco-cities. This advantage consists in profits to be gained from being the point of reference within the country, which stimulates private actors to compete to produce the first good reference system for eco-systems. They compete for national attention, professional recognition, public endorsement, and/or international visibility, a competition that seems to be somewhat more fierce in France than in Denmark. We observe, for instance, that the first reference guide produced in Denmark has been developed by a private construction fund, Realdania Arealudvikling, which has subsequently invited other private actors, namely two eco-city developers, to participate in the project. In France, the first reference system, HQE2R, was initiated in the public sector but then became a private initiative that operated in relative isolation. The second reference system, HQE Aménagement, has adopted a very different approach and mobilized support from a range of legitimate actors in the construction industry, public as well as private, some more sustainability-oriented and others more economic in their focus. This latter approach is highly competitive in the sense that they are competing not only with other private actors for a first-mover advantage but also with the ministerial initiative at MEDDEEM, which is developing their reference tool in relative isolation from other public and private organizations. The quest is one of

becoming *the* reference system for eco-cities in the minds of influential contractors and urban developers.

This comparison of the development processes in Denmark and France suggests a higher pace of development and a stronger fragmentation within the French construction sector than in the Danish equivalent. We do not know yet if their different approach to development produces a difference in the new design templates for sustainable construction that are emerging in the two countries. There certainly may be an institutional effect at this level, one that is worth exploring in the coming years.

The second difference we see is one of international inspiration. Although the actors in both countries seem to be equally aware of the most well-known reference systems for sustainable construction in the world, notably LEED (from the United States) and BREEAM (from the United Kingdom), they take a different stance in relation to them. Both of the Danish initiatives sought inspiration from international consultants and/or reference systems at the very early stages of their development process before deciding to develop their own (Realdania Arealudvikling) or to adapt foreign reference systems to the Danish context (SBI). In contrast, the French initiatives seem to explicitly avoid international imitation. They either take inspiration (or borrow the label) from national initiatives, such as HQE, which has become an established national standard for sustainable buildings, or they make efforts to be unique, or to appear as such. Yet, many of the French reference systems make explicit reference to different legislative and normative guidelines from France (e.g., French norms), Europe (e.g. European legislation), and the United States (e.g., ISO) upon which they build. Hence, we cannot conclude that there are objective differences in how much inspiration actors in the two countries take from abroad, only that it seems to be more legitimate and desirable to do so in Denmark than in France. Future data collection may help illuminate whether there are any objective differences in their respective sources of inspiration. If so, this element may potentially lead to the development of different design templates for sustainable construction in the two countries.

Regarding the relationship between reference systems and innovation, two contrasting logics seem to coexist within the production of reference systems for ecodistricts. The first one is coherent with a classical “command and control” logic and best represented by State initiatives (Meddeem in France appears as a good example). With its willingness to set stable, comparable and measurable

standards of performance and to converge towards replicable solutions, such a logic is coherent with rule-based design. The second logic is very careful about the risk to stifle innovative potential and strives to develop standards and reference systems while preserving the creativity potential of ecodistricts. Reference development obey a different logic and serve different objectives: reference systems are key to make sense of new practice, propose organizational devices and coordination tools, and organize exploration into coherent innovation fields. The best example of such reference systems is provided by Eiffage's HQVie® and HQE Aménagement® reference systems. This logic is more suited to the issues of low institutionalized practices, where sensemaking and framing innovation processes are key issues.

Further research should validate the present analysis, explore how these contrasted logics can / should coexist, and at what timing should rule based design be introduced into the process.

	Characteristics	Type of innovation	Relationship with institutional context	Critical dimensions of standard setting	Related initiatives for ecodistricts
Rule-based design	Stable value sources and performance targets, validation procedures, and coordination processes	Predictable, path-dependent logic (innovation converge towards a "dominant-design")	Compatible with a stable environment, highly institutionalized context (stable performance metrics, laws, established professions and expertise)	-Setting stable, measurable and comparable performance indicators -Converging towards stable technical solutions	Meddeem initiative
Innovative design	goals, division of labor, validation protocols, or design languages have to be reconsidered	Radical and disruptive: new path creation logic, exploring value-potential and new expertises	Radical institutional change, institutional vacuum	Framing exploration processes Communicating and making innovation "understandable"	Process / cognitive tools (Eiffage HQVie, HQE Aménagement)

CONCLUSION

We started this study with an interest in how sustainable construction is being expressed in different countries, and we end it with an agenda for future study. Some of the avenues we wish to explore in the time to come derive directly from this explorative study. We want to pursue the identification of national differences in the design templates for sustainable construction, both for innovation and standardization. We plan to do so within France and Denmark and hope to add other countries to the agenda, such as the United Kingdom and the Netherlands. Moreover, we plan to explore the

relationship between innovation and standardization within each country. This latter exploration should become particularly fruitful as emerging standardization initiatives begin to interact dynamically between the growing numbers of eco-cities under construction. The coming years represent the ideal timing for analyzing such developments and emerging relationships in real time.

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Appendix I A: Overview of identified cases – Eco Cities

Name of district	Number of residents	Surface	Launched	Expected to finish	Objectives
France					
Lyon (Les hauts de feuilly)			2006	2008	Environmental
Marne La Vallée Montrévain	3300	75/153 ha			
MLV le Sycomore de Bussy St Georges	3000		2009		
Projet MASER, Fontaine-bleau	16000	17200 ha forest/city	2010		Socio economic and Environmental
Lyon Confluences		150 ha	2003	2015	Socio economic and Environmental
Lille L'union		80 ha			
ZAC Bonne Grenoble	850	8,5 ha	2003	2009	Socio economic and Environmental
Presqu'île Grenoble		240 ha	2010		
Strasbourg Danube	600			2011	
Grand Large Dunkerque	1000 units/20000 inhab.	18/42 ha	2005	2009 +	Socio economic and environmental
Ecozac Paris					
MLV le Sycomore de Bussy St Georges	3000		2009		
Cité Wagner Mulhouse	600	10 ha	2000	2007	
Angers plateau des capucins (ZAC des Hauts de St Aubin)	6000	350 ha	2006	2020 ¹	
Bordeaux - Berges du Lac		36 ha	2007	2014	
Narbonne Théâtre	650	14 ha	2005	2009	
Rennes Courouzes		400 ha			
Grenoble Renov Gds Boulevards					
Denmark					
Gammelsø, Hedehusene,	7-8000		2005		Socio economic
Carlsberg byen	10.000	33ha	2007	2027-32	Socio economic
Ullerødbyen	Ca 5100 ²	150ha	2005		Environmental
Stenløse syd	Ca 2100 ³	25ha	2004		Environmental
Nordhavn	40.000 ⁴	200ha	2008	2048-58	Socio economic and Environmental
Västra hamnen			2001		Socio economic and Environmental
Ørestaden			1994	2009-14	Socio economic and Environmental
Amager Fælled Bykvarter	4.500	17ha	Development project	n.a.	Socio economic and environmental, incl.

¹ (1ères livraisons 2010)

² 1700 housings will be created – forecasted.

³ 700 housings will be made –forecasted

⁴ Forecasted by completion, following the completion of Ørestaden and Øst Amager Fælled

					CO ₂ neutrality
Ekostaden Augustenborg	5100 ⁵	32ha	1998		Socio economic and Environmental
Landsbyen Studsgård,	450		2004		Socio economic and Environmental
Fredericia C.	2500	20,4ha	2008		Socio economic and Environmental
Project Zero Sønderborg		Harbor area 5ha	2006	2029	Socio economic and environmental, incl. CO ₂ neutrality

⁵ 1700 housings will be created – forecasted

Appendix 1 B: Overview of identified cases – Social Housing

Name of district	Scope	Surface	Launched	Phase	Objectives
France					
Nanterre's project (123 accommodations)	123 homes	9055m ²	2005	Sketch in progress	
Bondy's Terre St Blaise project	89 homes	7290m ²		Sketch in progress	
66 Logements sociaux	66 homes	5200m ²	1999	Tender being ⁶	
Paris Habitat-OPH	multiple	multiple	multiple	On-going	
Denmark					
Lejerbo, Kolding			2010	2014	reduction in energy-consumption
Vridsølille, Albertslund			2009	2014	reduction in energy-consumption, cost, comfort
Gate 21: Plan C, Albertslund			2010	2013	reduction in energy-consumption, development of the building industry
Heimdalsvej, Frederikssund		18000m ²	2008		reduction in energy-consumption, cost, passive house standard
Vejleåparken, Ishøj			2003	2008	reduction in energy-consumption, cost
Ringgården, afd. 4, Århus		4200 m ²	2004		reduction in energy-consumption, passive house standard
Tåstrupgård			2000	2004	reduction in energy-consumption
Gyldenrisparken, Amager	450 homes				reduction in energy-consumption
Avedøre Stationsby		69ha			reduction in energy-consumption

⁶ Competition underway

Appendix 2: Description of selected cases for innovation (Question 2)

Amager Fælled Bykvarter: is one of the development areas within the Ørestad development project established by The CPH City and Port Development company, and it has not yet been developed. In light of the Municipality of Copenhagen planning to be CO₂ neutral by 2025, consultants, planners and developers have worked for over a year on determining what it would take in terms of construction, technologies, changes of consumption and transport patterns as well as policies to turn this neighborhood into a CO₂ neutral one. Although this project is still on the ‘drawing board’, the ideas are well documented in numerous reports and conference proceedings that will provide valuable insights as to how various professionals conceptualize and work on developing eco-cities/districts. For info:

<http://www.kk.dk/sitecore/content/Subsites/Klima/SubsiteFrontpage/HvadGoerKoebenhavnsKommune/Indsatser/BaeredygtigByudvikling/AmagerFaelledBykvarter/Debatmoeder.aspx>

Paris Habitat-OPH: Of the 800 agencies that manage public housing in France, 282 are OPH (Office Public de l'Habitat) agencies. Under private law accounting, such public housing agencies are subject to government control and must comply with the Public Contracts Code. Paris Habitat-OPH was founded in 1912 and is the largest public housing agency in France. It operates in three different areas: housing development, real estate management of the developed housing, and development policies for the city of Paris. Studying OPH will provide access to extensive data on cases of experimentations in social housing in France. For further information about Paris Habitat-OPH see:

<http://www.parishabitatoph.fr/OPAC/OfficePublic/Pages/ParisHabitat-OPH.aspx>

Grand Large Dunkerque: is an eco-territory in Dunkerque, the largest North Sea port in France. Recipient of a European Sustainable City award, the project has reached an advanced stage of construction. The eco-territory integrates CO₂ reduction with economic performance, social diversity, and urban development, involving citizens and potential users in the decision-making processes. Its newly constructed collective housing blocks have solar cells, green roof tops, rain water collection, a water management system, a high-performing urban heating system, and an ecological wall. We will study this project in retrospect, examining how its sustainability performance and technological solutions took shape during construction. For further information, see [http://www.communaute-urbaine-](http://www.communaute-urbaine-dunkerque.fr/fileadmin/user_upload/pdf/Institution/Presse_pdf/grandlarge1.pdf)

[dunkerque.fr/fileadmin/user_upload/pdf/Institution/Presse_pdf/grandlarge1.pdf](http://www.communaute-urbaine-dunkerque.fr/fileadmin/user_upload/pdf/Institution/Presse_pdf/grandlarge1.pdf)

Appendix 3: Interview Guide - Standardization / eco-cities

Theme 1: The origin of the reference system

This theme explores the context in which the reference system has been created, the actors involved, the targeted objectives, its financing, events that provoked its emergence, etc.

- Who participated in elaborating it?
- Who supported politically and/ or financially the creation of the reference system – and with which objective in mind?
- Have there been particular events that stimulated its creation?
- Which components of the reference system were considered from the very beginning to be essential and which ones were added later (why)?

Theme 2: Its current status

This theme seeks to shed light on the current diffusion, as precisely as possible, before exploring its current level of use.

- How is it different from/ similar to other reference systems available on the market and also relevant for eco-cities?
- Who is currently using this reference system?
- Why, according to you, do some actors choose to use your reference system (why do other actors not use it)?
- Has the reference system been as popular as hoped for at the outset? If not, how do you explain this development?

Theme 3: Its future prospects

This last theme seeks to understand the political engagement that supports its future diffusion as well as the obstacles that may slow down such diffusion?

- Are there actors, in your group or elsewhere, that are currently fighting for this reference system to become more widespread (what do they do exactly)?
- What are the prospects, in your opinion, that this reference system will become one of the most widespread ones in Denmark/ France ten years from now?
- What are the most important obstacles to its diffusion?

APPENDIX 4: COMPARATIVE TABLE- REFERENCE SYSTEM

		DENMARK	FRANCE			
Reference system		Realdania Arealudvikling	AFNOR	HQE Amenagement	MEEDDM (Référentiel Ecoquartiers)	HQE2R
Content	Dimensions	1. Environmental	1. Environmental	1. Territorial integration	1. Environmental	1.Preserve and enhance the legacy and keep resources
		2. Social/ health	2. Social/ Governance	2. Environmental quality and sanitation	2. Social/ Governance	2.Local environmental quality
		3. Economic	3. Economic	3. Social life and economic life	3. Economic	3.Mixed social functions, generation
	Themes/ elements	1. Energy, transport, water, waste, environmental behavior		1. Territory and local context – density - mobility and accessibility - patrimony, landscape and identity - adaptability and evolution	1. Energy, waste, water, mobility, biodiversity, urban forms, eco-construction	1.Energy, water, space, materials use, patrimony
		2. physical framework, urban life, health and diversity		2. Water - energy and climate - materials and equipment -waste - ecosystems and biodiversity - natural risks and technologies - health	2. Governance and participation, social diversity and intergenerational, Strengthening social ties (social cohesion and security), Promoting accessibility to services and amenities)	2. Natural landscape, housing improvement, hygiene & health, security & safety, air quality, noise, Waste.
		3. Costs of all nine themes mentioned above		3. Project economy - functions and social diversity - ambiance and public spaces - workforce integration and education - local economic dynamics	3. Optimize the economic project, ensuring the sustainability of the project	3. Population diversity, institutional diversity, Diverse housing.
						4. Education & training, accessibility of employment, services and equipment, general quality of life, mobility.
						5. Social cohesion and citizen involvement, solidarity and social capital.
	Indicators	Subjective, quantitative. Each theme has specific indicators (70 in total) that can be evaluated on a scale from 1 to 5. 1 is minimum legal requirement, 2 is national average.	Quantitative and qualitative.	Subjective, qualitative. Each theme is further defined and specified, but remains non-measurable.	Subjective, Each theme has specific indicators, but there are no measures yet. For the contest, each indicator is rated with 0-3 stars.	Subjective, quantitative and qualitative. The indicator system ISDIS (Integrated Sustainable Development Indicators System) consists of objectives, targets, sub-targets and indicators of sustainable development for a renovation project area. Scores range from -3 to +3.
Integrates other norms, laws, reference systems		Minimal legal requirements are assigned a score of 1.	NF	ISO 9 000 & 14 000; NF; AEU Ademe (strong reference to this last initiative), + effort to articulate with PLU, SCOTT, which have legal value)	RST02 (reference system from the Ministry of Equipment). NF, ISO and European norms.	European norms.

APPENDIX 4: COMPARATIVE TABLE- REFERENCE SYSTEM

	DENMARK	FRANCE			
Reference system	Realdania Arealudvikling	AFNOR	HQE Amenagement	MEEDDM (Référentiel Ecoquartiers)	HQE2R
Process	<p>1. Sustainability targets adapted to the locality are selected.</p> <p>2. Specific indicators are selected for each theme.</p> <p>3. Proposed solutions are rated to identify their sustainability profile.</p> <p>4. Sustainability profile is rated in relation to other project parameters.</p> <p>5. The economic dimension of the sustainability profile is considered in relation to project economy.</p>		<p>SMO (Management System of the Operation) is at the core of the referential. Details 6 stages, in terms of management tools, participation, and outputs (referred to as “evaluation”):</p> <ol style="list-style-type: none"> 1. launch 2. initial analysis 3. defining and contracting objectives 4. project design & actions decisions 5. operationalization 6. evaluation and capitalization <p>each stage is then detailed in term of actors and stakeholders who should be taken into account, and the expected outcomes</p> <p>“The SMO” enables to raise the right questions at the right moments, with the appropriate actors“. Applying the SMO should strengthen the first stages of the project (diagnosis)</p> <p>Evaluation is said to be “essential” p.10 but not prescribed: p.36: “The choices and relevance of indicators remain context specific, it is a function of what actors try to evaluate”. Pick & Choose logic. Recognition that social dimension is hard to evaluate. The referential makes propositions for indicators but does not prescribe any of them. These indicators can be related to the quality of the project management or to the impact of the project.</p> <p>List 6 general sustainability issues and connect them with global indicators</p>	<p>1. Sustainability targets adapted to the locality are selected.</p> <p>2. Participatory Democracy.</p> <p>3. Maximizing the financial and overall project cost.</p>	<p>1. Decision (strategy, identification of problems) Participatory Democracy</p> <p>2. Analysis (inventory diagnosis)</p> <p>Sustainability targets adapted to the locality are selected</p> <p>3. Evaluation (scenario development) sustainable energy cost,</p> <p>4. Action (specifications, planning regulations).</p>
Output (graphics, scores, label, certification)	<p>Spiderweb graphics are made for each of the three dimensions. Each element/theme within each spiderweb is then assigned a weight (%) to calculate an overall sustainability profile.</p>	<p>Certification will be given (normalized)</p>	<p>Debates around certification are still open.</p> <p>Evaluation is very open</p>	<p>No certification for the moment, just the right to participate in the National Club of sustainable neighborhoods.</p> <p>No commitment to output of evaluation for the moment, but may use spiderweb from RST02 (their baseline).</p>	<p>Spiderweb graphics are made for each of the three dimensions. Action Plan. No certification.</p>

Legend: vvvvvv= overlap across reference systems; vvvvvv = overlap between most of them; vvvvvv = overlap between two reference systems; vvvvvv= general trend

APPENDIX 5 : COMPARATIVE GRID – INTERVIEWS RELATED TO REFERENCE SYSTEMS

Initiative	Realdania Arealudvikling	Statens Byggeforskningsinstitut (SBI)	Dansk Standard	HQE2R	HQE Aménagement	Meeddem Ecoquartiers	HQV® (Haute Qualité de Vie)
Contact				Philippe Outrequin Catherine Charlot-Valdieu	Pierre Ferlin (OPAC Oise) Isabelle Baer (SNAL)	Franck Faucheux	Maxime Pain Valérie David
THEME 1: ORIGIN OF THE REFERENCE SYSTEM							
Starting date of the project	Mid 2008	2010, initiative under development right now	No project to date for eco-cities – norms for building and building parts only	1999 European project on renewing urban districts with a sustainable approach	2004: initiation of a working group about methodologies January 2007: a 3 years long experimentation was launched on 10 projects to test the methodology in a real world context	2008: initiation of a sustainable neighborhood competition “Concours Ecoquartier”	2007
Date of publication of the first version of referential	Not public yet	Not public yet	NA	2004	March 2010	Not public yet	2010
Who participated in elaborating it?	Realdania Arealudvikling, sub-unit of a private Danish fund for construction “We have been more or less working with this alone”.	The core participants are from SBI and major Danish engineering consultancies (COWI, Rambøll). They are creating a <i>Danish Green Building Council</i> .	Involved in projects at the building level, connected with the Danish building Code, some of them mandatory	10 research centres and 13 cities in 7 countries Different skills (economists, architects, engineers, public representatives and environmental activists, but lack of sociologist) Managed by Catherine Charlot Valdieu from CSTB (at the time)	The project was first initiated and financed by FNAL (National federation of Housing Estate), and merged with an internal project about urban planning within HQE HQE, ADEME, CSTB, CICF (engineers), FEPP (local public companies), UNSFA (architects), urban planners	Public institutions only (CETE, CSTB, MEEDDM, CERTU)	Pilot : Eiffage sustainability department Within the project: Eiffage teams + external experts (sociologists, urbanists, etc.)
Political / financial support –which objective in mind?	Carlsberg and By & Havn: financial support of the development of process tool	Many other players, private and public, are being involved now in the process. Financing comes from members of the steering group (initiators and large commercial producers).	These norms are developed by Dansk Standard in collaboration with large commercial producers of building components. Public actors supporting their development:	Funded by EU (2/3), participating cities, and PUCA	Political support from MEEDDEM (launch of the project) Financial support from FNAL and ADEME which funded the methodology	Political and financial support only from MEEDDEM	100% Eiffage: prospective work on renewing business models and practices. Positioning Eiffage as a legitimate actor in

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Initiative	Realdania Arealudvikling	Statens Byggeforskningsinstitut (SBI)	Dansk Standard	HQE2R	HQE Aménagement	Meeddem Ecoquartiers	HQV® (Haute Qualité de Vie)
			Erhvervs- and Byggestyrelsen (EBST), Statens Byggeforskningsinstitut (SBI), and Denmark's Technical University (DTU).		development		sustainable urban planning towards its clients Tried to get funding from ANR to work with research centers in ergonomics and use, but failed, maybe for political reasons.
Stimulating event	Preparing Realdania for a competition for a sust.urban project in Køge - Spring 2010	Not clearly. More related to the "zeitgeist": "International discussions around CO2 reduction that reemerged two years ago, perhaps combined with a change in government orientation"	Influence of ISO over the process	EU calls for project???	"local communities began to ask for HQE urban operations" Internal to HQE: internal commission after a trip to major European examples of ecocities in 1992	Environmental bill " Grenelle de l'Environnement " and sustainable neighborhood competition "Concours Ecoquartier"	HQVie® is one output of Phosphore, a broader internal R&D project initiated by Eiffage sustainability department in 2007 and still under development. This prospective project makes hypotheses on strong evolutions in the building environment in 2030 (social, environmental, fiscal evolutions, etc.), and explores conceptual and technical innovations related to these evolutions.
Essential components / components added later (why)?	Environment was first, then social, then economic sustainability	<i>Components related to the individual building and dimensions that are included in the international systems, like BREEAM and LEED.</i>	NA	??	Strong reference to AEU (methodology designed by ADEME for environmental assessment of urban projects) aimed at getting the support of ADEME.	Social first, then environment, then economical sustainability and urban	Strong link with Phosphore: structuring our methodology and approach, formalizing and systematizing what we did on this

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Initiative	Realdania Arealudvikling	Statens Byggeforskningsinstitut (SBI)	Dansk Standard	HQE2R	HQE Aménagement	Meeddem Ecoquartiers	HQV® (Haute Qualité de Vie)
	Very difficult to incorporate social dimension and urban development dimensions – measurement difficulties				<p>The environmental dimension was the dominant logic, social and economic components were added after experimentations</p> <p>Very process-driven, effort to put stronger emphasis on evaluation and objectives at the end.</p>	development dimensions	<p>project.</p> <p>Wanted to develop a systemic approach, not reduced to technical choices</p>
THEME 2: CURRENT STATUS OF THE REFERENCE SYSTEM							
Differences / similarities to other reference systems for eco-cities?	<p>“Better adapted to the Danish context”. Had to work on the adaptation on the Danish context with a group of consultants</p>	<p>Governmental building authorities have set a group, involving all actors from the building industry, for adapting international standards for green building (Breeam, Leed) to the Danish sector</p>	<p><i>DS 418 is not so different from the European equivalent of TC 89.</i></p>	<p>HQE2R is no referential or standard, it is an open tool, that is not subject to verification or certification</p>	<p>Much more process/quality driven than international standards (Leed / bream)</p> <p>Objectives are to be context-specific, leaves a large amount of latitude to local actors</p> <p>Core= Management System of the Operation (SMO)</p>	<p>No process driven like a HQE Management and HQE2R</p> <p>Quality system applied to urban planning and rural planning</p> <p>“Better adapted to the French context”(Governance, Sprawl, Participatory democracy)</p>	<p>Systemic approach based on principles</p> <p>Internal work to show that the reference system is more encompassing than existing ones (HQE®, Leed, Breeam)</p> <p>No fixed requirements or technical req. except for energy (PassivHaus at least)</p> <p>BUT opposed to the optional logic which prevails in HQE®</p> <p>No SMO, no perf. Indicators to date (to be done in 2010-11)</p>
Who is currently using this reference system?	<p>Themselves only. Not publicly available yet</p>	<p>N/A</p> <p>Under development</p>	<p><i>All Danish construction actors have to respect DS 418 to the extent mentioned in</i></p>	<p>Mostly students on urban. Success in Belgium and Switzerland (French speaking part)</p>	<p>Just launched, do not know yet.</p> <p>Each contributor will promote the framework</p>	<p>Under development, Not publicly available yet</p>	<p>Eiffage for proposals, and partners (mostly architects)</p>

APPENDIX 5 : COMPARATIVE GRID – INTERVIEWS RELATED TO REFERENCE SYSTEMS

Initiative	Realdania Arealudvikling	Statens Byggeforskningsinstitut (SBI)	Dansk Standard	HQE2R	HQE Aménagement	Meeddem Ecoquartiers	HQV® (Haute Qualité de Vie)
			<i>Bygningsreglementet.</i>		within its network/institution 10 projects as experiments in France		
Reasons for choosing / not choosing this reference system?	NA			Good methodology for urban renewal + no dogmatic use (methodology can be adapted according to people needs) “It is a methodology. No one uses it from A to Z”	Visibility of HQE® (existing standard at the building level) will facilitate diffusion Actors looking for methodologies Others factors likely to evolve: - Endorsement by public actors? - getting a label	Strong political desire	“Cognitive tool”, providing a “common language” for organizing, prioritizing a project
Has the reference system met the expected success? If not, why?	NA			Today: available on a web site. 20 uploads per day	The launch was a success (more than 300 people attended): interest of the public and local actors for the process + support from the secretary of state	Yes especially in private companies which want to know the performance indicators	Depends... Appeal of several urban communities + international association for urban planning + multinational cies (potential partners like GDF Suez, Lafarge) BUT harder with State representatives (ministries)
THEME 3: FUTURE STATUS OF THE REFERENCE SYSTEM							
Who is promoting this system and how?	Not really (yet). Still at the experimental stage. Realdania Arealudvikling is	<i>Lots of work is being done to assemble actors across the Danish construction sector to participate in the choice and</i>		weak dimension of the project: no support from the French state or public representatives	Cf list of supporting actors. Good work in enrolling representatives from the various bodies of the	Not really (yet). Still at the building	Eiffage, but low institutional communication in

APPENDIX 5 : COMPARATIVE GRID – INTERVIEWS RELATED TO REFERENCE SYSTEMS

Initiative	Realdania Arealudvikling	Statens Byggeforskningsinstitut (SBI)	Dansk Standard	HQE2R	HQE Aménagement	Meeddem Ecoquartiers	HQV® (Haute Qualité de Vie)
	speaking informally to the Ministry of Climate as well.	<i>adaptation of an international reference system, probably BREEAM or LEED, planned for May - December 2010</i>		“We are marginalized, we are marginal people. We are the ones who dare to say what other people prefer to keep silent” Support from Europe???	building process	stage. but in the future it is the State (MEEDDM, CSTB) that will promote this standard	France Hopefully international association
Likelihood of becoming one of the most widespread ones in Denmark/ France ten years from now?	Hesitant	Good		Very very low	Actors met expect it to be good for France, if they manage to get significant projects and to articulate HQE Aménagement with the Meeddem initiative for ecocities	Very Good	Given the power of dominant actors (Vinci or Lafarge) decision not to invest too much in the French context, but to get international recognition to get legitimacy
Obstacles to diffusion?	Need to be simplified to make it easier to use Difficult to go into certification in the field of urban development (context specific)	<i>It is unusual to develop standards from voluntary initiatives led by private actors, and architects may be particularly sensitive to this (engineers gain importance with these standards).</i>		1) There was a strong lobbying from CSTB & PUCA representatives to “kill” the initiative and failure to get support from other actors other public actors (PUCA, Certu, Ademe)« Le lobbying été complètement absent et nous avons été confrontés à des forces qui nous ont complètement dépassés ».Reasons: perceived competition between HQE2R and HQE + personal relationships 2) creation of ANRU in 2002 made it more difficult for local actors to use the methodology	Some harsh opponents in particular in architecture. Criticism for excessive bureaucracy / Fear of a label without clear performance requirements (greenwashing)	Elected officials do not agree with the law of the “Grenelle Environment.”	Powerful competitors are bothered, French public actors are not supportive. Public action is very fragmented in the field.

APPENDIX 6: COMPARATIVE TABLE - INNOVATION

Project	OPH Paris habitat (FR)	Grand Large (FR)	Amager Fælled Bykvarter – AFB (DK)
Description	Refurbishment Project. Tour Bois le Prêtre, France (2005-2009)	Dunkerque, France (2002-2015)	Copenhagen, Amager, Denmark (2008-2009)
Describe the Business as Usual (BAU) : <ul style="list-style-type: none"> Former projects and concepts Limits of former projects with respect to sustainability 	<ul style="list-style-type: none"> Building « modern ensemble », previous tower built in 1958, improve comfort Prefab elements on a concrete « vail » Refurbishment (90) : reduce energy consumption and renovate the facade : external insulation and double glazing Limits: ugly, noisy (the ring road next to the tower was built beside in 1966) 	<ul style="list-style-type: none"> new experiment in France 	<ul style="list-style-type: none"> Developing green field sites usually involves : <ul style="list-style-type: none"> an architectural competition calls of tender choice of developer, contractors, etc With little or no emphasis on sustainability.
What is the innovative project? <ul style="list-style-type: none"> describe the disruptive concept(s) (keywords) related to sustainability in the actors own language What is made visible (ex.: technical and aesthetics), calculable or only discursive? 	<p>The project: it is a refurbishment social housing project. After a consultation with the lodgers, decision was made to conserve to refurbish the concrete tower built in 1958 rather demolish and “rebuild a new building”, a solution usually recommended by experts.</p> <p>Disruptive concept :</p> <ul style="list-style-type: none"> Improve « living conditions » (space, light, collective spaces), « aesthetics of the ordinary », reduce energy, heating, reduce nuisances during the works), etc.), demonstrate that « refurbishment » can be cheaper and as performing as « demolish and rebuild » Participatory design with lodgers (from the beginning?) The project is part of a broader « urban renewal project » in Paris and at the state level (ANRU) 	<p>The project: The demise of shipbuilding in Dunkerque has released large territories close to the city center. In the late 80s, spurred Michel Delebarre new Mayor of Dunkerque, set a strategy of urban and industrial renovation. After an international competition, organized in 1991, a urban renovation city project (Neptune project) of Richard Rogers is selected. It encompasses the design of different facilities (transport, housings, services) in a global concept. A new actor - the SEM - was created to carry out the Neptune project. It will result in the creation of infrastructure connecting these areas to the city by upgrading of the city center. Primarily residential, it includes the construction of approximately 1000 homes, some service industries and shops nearby, 16hectares between 2009 and 2015.</p> <p>The legal tool (ZAC) was created in 1995. North and includes the construction of many facilities Cultural Fund as the Regional Museum of Contemporary Art, sports and leisure as a bowling alley. The first facility, delivered in</p> <p>Concept</p> <p>new urban area with different housings (mixing different population (age and revenue), renovate an old vacant industrial land and promote a sustainable neighborhood.</p> <p>Visible</p> <ul style="list-style-type: none"> design to cost (replicability of the project) architectural form (Flemish style compatible with bioclimatic design (minimize heat losses) 	<p>The project: the aim was to help qualify the city of Copenhagen’s decision making processes when it comes to developing new parts of the city, i.e. to qualify the city as a client. The aim of the project was to see what it takes to establish an urban area that could be CO2-neutral and « environmentally, socially and financially sustainable ». To this end, the city of Cph engaged with a long range of experts, and asked them to identify the conditions for CO2 neutrality within their respective fields. The city concluded at the final conference (Oct 2009) that: « We can develop a CO2-neutral district, and it does not need to be more expensive (than conventional development), but it requires: a holistic approach to urban development, innovation, the will to use the steering tools available, and collaboration.”</p> <p>Phase 1 on the project consisted of a number of consultants (primarily from engineering companies) to go beyond ‘best practice’ and develop innovative approaches to sustainability in a number of areas, i.e.:</p> <ul style="list-style-type: none"> Energy supply Water, Waste, Transport Infrastructure planning Behavior and consumption of goods <p>Results from each report were used to calculate the area’s CO2 _ footprint, and based on this the city of Cph decided which policy instruments would be needed to realize this goal.</p>
What is the added value (for whom) of the	Added value :	Added value :	A financial analysis showed that :

APPENDIX 6: COMPARATIVE TABLE - INNOVATION

Project	OPH Paris habitat (FR)	Grand Large (FR)	Amager Fælled Bykvarter – AFB (DK)
<p>project?</p> <ul style="list-style-type: none"> - How performance is measured - (qualitative vs. quantitative)? 	<ul style="list-style-type: none"> - for the client (image, a first experiment for further refurbishment projects) - lodgers (consultation, lower lodging charges, increased comfort) - architects : demonstrate their skill <p>Performance measurement : energy efficiency, global costing (life cycle), qualitative assessment grid (SD charter) for project consultation (first version set in 2005), adapted for each project (17 targets)</p>	<ul style="list-style-type: none"> - reasonable cost - environmental targets : waste, energy efficiency, aesthetics - social targets <p>Famous architect (Nicolas Michelin) : demonstrate its skill</p> <p>The project performance is not measured. The SEM would make the new BBC buildings islets (projects to be initiated within 2 years) and building performance could be better monitored. Cella is an error because the project environmental performance, economic and even social measure should be now</p>	<ul style="list-style-type: none"> - It must not be more expensive to build and live in a CO2-neutral district - It may be possible, without extra cost - but requires new forms of collaboration and better organization of the construction process - Possible to obtain cost savings by saving man hours on better thought-out solutions and with new thinking in the construction process - Development of energy prices for fossil fuels makes it more attractive to make urban development CO2-neutral - With regard to physical planning the results were : <ul style="list-style-type: none"> - Think energy-reducing steps in planning from the outset - Build a densely-packed district and with mixed functions - Use the existing public transport - Use daylight optimally - Plan robustly and flexibly - Generate awareness of when the different players should be involved - There are no significant legislative barriers to introducing the CO2-reducing instruments, but it's important <ul style="list-style-type: none"> - instruments for agreements / land registration should be used - owner should set demands when selling land - Planning principles which consider CO2 reduction should be included into competition programs and be weighty parameters when evaluating the proposals received - Each consultant used a number of calculative devices to make their (respective) case. - The project provided the city of Cph with 'proof' that it would be possible, but also difficult, to establish a CO2 neutral district.
<p>Who are the actors of the innovation process?</p> <ul style="list-style-type: none"> project ownership (client) project manager Project executor (architect. /engineer...) project management assistance (for sustainability) Have they built a specific doctrine on SD? 	<ul style="list-style-type: none"> - OPAC (OPH) (both client, project manager and developer : build the program, organize the call, built returns of experiments, supervise the design and building <ul style="list-style-type: none"> - Try to develop a doctrine for SD programs (SD charter, participatory design) - Project management assistance SD (new): H.Jorda (architect) helped the OPH to build 	<ul style="list-style-type: none"> - The main actors are the Urban Community of Dunkerque (CUD) (client) who developed a political vision and an innovative approach of urban planning - the SEM (a public-private agency) is the developer and project manager acting for the client (municipality – CUD). The SEM has supervised all the steps of the project. They have 	<ul style="list-style-type: none"> - The project owner is the city of Copenhagen, who conducted the project in collaboration with the urban developer (By og Havn/City and Harbour) likely to develop it one day. - Apart from the city of Cph, there were numerous companies involved : <ul style="list-style-type: none"> - Københavns Energi and GBL (Gruppen for by og

APPENDIX 6: COMPARATIVE TABLE - INNOVATION

Project	OPH Paris habitat (FR)	Grand Large (FR)	Amager Fælled Bykvarter – AFB (DK)
<ul style="list-style-type: none"> What are their distinctive skills in relation to sustainability? 	<p>the program for the project, set SD targets...</p> <ul style="list-style-type: none"> - She is a well-known specialist of SC in France (owned several prizes) - architect : Lacaton & Vassal - built a doctrine on ecosocial housing (towers) (PLUS report for the Ministry of Culture, « aesthetics of the ordinary » (luminosity, environmental performance, living conditions), propose an architectural approach of refurbishment - participated in the Mulhouse experiment - Lodgers - City of Paris - Prescribers (ministry of housing) 	<p>full delegation for the development of the district.</p> <ul style="list-style-type: none"> - Architect: Nicolas Michelin (known for the design of eco neighborhoods in France). Architect was chosen during a pageant (directed by the SEM but chaired by the President of the CUD and Mayor of Dunkerque). Nicolas Michelin is the planner of the entire operation (all groups combined) and architect of the first step. Concept : create a friendly neighborhood where people want to live together. Make no difference between social and private housing. - Real estate developers (private) who have contributed financially to the effort of high architectural quality in both private and public housing. - No external assistance on sustainable development - No consultation with the public 	<p>landskabsplanlægning) - a utility company and a landscaping consultancy – focused on water management</p> <ul style="list-style-type: none"> - Cowi (an engineering consultancy) focused on managing wastes and on transport-related issues - SBI/Danish Research Institute on Housing focused on the behavioral aspects - Esbensen, an engineering consultancy focused on energy supply - Juul & Frost, an architectural company, focused on planning land use, etc . - All of these experts were asked to demonstrate their competences and go beyond best practice. Most of the consultants stuck, however, to standard approaches. Esbensen is perhaps the most innovative – they have developed a « sustainability rosette » much like a wind rosette.
<p>When did it happen?</p> <ul style="list-style-type: none"> start of the project or organized reflection on SD antecedents in the organization (even very partial) antecedents outside the organization (external influence) 	<ul style="list-style-type: none"> - 2005. First prominent refurbishment sustainability project in Paris - Previous experiments (Impasse Le gué (new social housing 2004-2008 (external insulation, vegetalized roofings, ventilation...)) - Mulhouse (cité Manifeste (2001) with the same architect - -Vauban (Germany) 	<ul style="list-style-type: none"> - 2004 - Announcement of the project by Michel Delebarre during an interview - Industrial ecology : heating provided from Arcelor plant (reduce CO2 emissions) - waste Policy for 20 years - The Grand Large project forms part of a comprehensive urban renovation plan (Neptune) that was not initially oriented towards sustainability objectives 	<ul style="list-style-type: none"> - The project started in March 2008 and lasted until Oct 2009. - The backdrop for the project is the city of Cph vision of being « the world's climate capital », meaning that the city should be : <ul style="list-style-type: none"> - "Green, clean and healthy - A good city to live and move around in - for everyone - And that consideration for the environment should be in everything we do"
<p>Why did it happen according to the actors?</p> <ul style="list-style-type: none"> Key drivers? (Political support, opportunities...) Building new potentials for the future? 	<ul style="list-style-type: none"> - Political support and vision (Paris, state) : 2002 : urban renewal project (Paris), Porte Pouchet (one of the 11 urban areas concerned) - Important financial means (ten times higher than for usual refurbishment programs) - A first experiment to build a sustainability Policy for OPH Paris. Opportunities for designers to demonstrate their skill 	<ul style="list-style-type: none"> - Political support and vision (Dunkerque). Total political support of Mayor and Chairman of the Urban Community of Dunkerque. The Mayor lead in this project the opportunity to show the achievement of its policy of sustainable development. - New buildings in Grand Large have a major testing ground. They are not BBC or THPE (Very high energy efficiency). But are the first buildings bioclimatiques Dunkerque. 	<ul style="list-style-type: none"> - The political priority of the city of Cph to the climate capital was a strong influence. Branding the city was particularly important up to COP 15. - Also, the development company By & Havn had a keen interest in seeing how much could be achieved with existing measures. By & Havn have another and much larger development project on the drawing board – in Nordhavn. This area is to be sustainable and house some 40.000 inhab. And 40.000 jobs.
<p>What are the distinctive characteristics of the innovation process/ « dominant design »?</p> <ul style="list-style-type: none"> project conduct and organization 	<ul style="list-style-type: none"> - Project : efforts put on the program definition (ambitious targets) - Life cycle Tools and thinking 	<ul style="list-style-type: none"> - Legal and contractual innovations - short deadlines (2 years) 	<ul style="list-style-type: none"> - The project target was ambitious, and the project showed that it was possible to achieve (all depending on how the borders

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Project	OPH Paris habitat (FR)	Grand Large (FR)	Amager Fælled Bykvarter – AFB (DK)
<ul style="list-style-type: none"> tools and models used legal, financial resources new ways of conducting experiments 	<ul style="list-style-type: none"> Building returns of experiment after the delivery of the building : measure (environmental) in-situ performance and qualitative studies of satisfaction 	<ul style="list-style-type: none"> Price of housing set from the start as a design principle Decision very early on to improve energy management and waste collection in the districts 	<p>to the area are drawn, i.e. particularly with regard to the supply of energy from e.g. district heating).</p> <ul style="list-style-type: none"> All of the involved experts used a number of more or less conventional tools with regard to resource optimization within their respective fields.
Surprises of the innovation process? <ul style="list-style-type: none"> turning points events 	<ul style="list-style-type: none"> Needs expressed by lodgers. They preferred to conserve the tower (luminosity, conviviality, sightseeing) rather than destroy it Active involvement of lodgers in the process Supplementary delays induced by the « step by step » approach (lodgers stay in the tower during the works) 	<ul style="list-style-type: none"> cancellation of a technical innovation (dual-flow ventilation) because a public agency did not deliver the product homologation on time 	<ul style="list-style-type: none"> How difficult it is to define and achieve CO2 neutrality. The dark horse in this will be the inhabitants and how they behave.
What are the main obstacles encountered? <ul style="list-style-type: none"> lack of incentives (economic, legal framework) lack of knowledge organizational routines concurrent engineering 	<ul style="list-style-type: none"> Costly experimentation (budget 10 times higher than standard refurbishment even if the cost was lower than for “demolish and rebuild” proposals) Constraints of the legal framework (market public codes) to conduct innovative experiments Tension between freedom of designers (archi) vs. interventionism of developer and project managers 	<ul style="list-style-type: none"> costly experimentation Funders were reluctant about innovation. For them, inhabitants are not yet ready to change their behavior 	<ul style="list-style-type: none"> See above.
Matters of scale: from the building to urban areas?	<ul style="list-style-type: none"> Question: how do such towers fit with urban renovation plan? Limits of incrementalism? Meet the architect in charge of the urban area (Porte Pouchet) 	<ul style="list-style-type: none"> The project is scrutinized by other municipalities as an interesting experiment to renovate industrial vacant lands and redensify cities. 	<ul style="list-style-type: none"> Results from this project will be used to inform the city of Cph’s other projects. It is considered a valuable « thought experiment ». The area will not be developed for the next several years (because of the economic crisis).
Replicability of innovation : - What was learned? <ul style="list-style-type: none"> Design principles? New ways of organizing? New ways of conducting partnerships? New ways of designing and testing value-driven performance? 	<ul style="list-style-type: none"> Participatory design method for refurbishment Knowledge transfer for other projects (Tools, methods, partnerships) New performance program setting Returns on experiment Poster for the exposition Pavillon de l’Arsenal in 2009 	<ul style="list-style-type: none"> the contractual and legal approach was apparently replicated, with few adjustments, in the city of Bordeaux for a urban planning renovation plan. The same architect was selected. methods, tools and insights are still in the process of formalization 	<ul style="list-style-type: none"> Many of the insights, Tools and methods can be used in other projects/settings.